PATENT ABSTRACTS OF JAPAN

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(71)Applicant : KOBE STEEL LTD

(72)Inventor : OGURA TETSUZO

(54) COPPER ALLOY FOR ELECTRICAL AND ELECTRONIC PARTS

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a copper alloy for electrical and electronic parts good in strength, electrical conductivity, heat resistance, arc wear resistance, mechanical wear resistance or the like and also small in the reduction of thermal conductivity owing to heat generation by energizing.

SOLUTION: This copper alloy has a compsn. contg., by weight, 0.01 to 0.3% Ag, 0.005 to <0.02% Fe and 0.005 to <0.05% P, moreover contg., at need, one or ≥ two kinds selected from each element of B, C, S, Ca, V, Ga, Ge, Nb, Mo, Hf, Ta, Bi, Pb, Be, Mg, Al, Ti, Cr, Mn, Ni, Co, Zr, Cd, In, Sb, Si, Sn, Te and Au by 0.001 to 0.1% and 0.001 to 1% Zn by ≤1% in total, and the balance Cu with inevitable impurities.

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Ag: The electrical and electric equipment and the copper alloy for electronic parts characterized by the bird clapper from Remainder Cu and an unescapable impurity 0.01 - 0.3wt% including less than [Fe:0.005-0.02wt%] and P:0.005 - 0.05wt%.
[Claim 2] Ag: 0.01 - 0.3wt%, less than [Fe:0.005-0.02wt%], P:0.005 - 0.05wt% is included. further B, C, S, calcium, V, Ga, germanium, Nb, Mo, Hf, Ta, Bi, Pb, Be, Mg, aluminum, Ti, Cr, Mn, nickel, Co, Zr, Cd, In, Sb, Si, one sort or two sorts or more of elements chosen from from while of each element [of Sn, Te, and Au] 0.001 - 0.1wt%, and Zn:0.001 - 1wt% -- the sum total -- less than [1wt%] -- the electrical and electric equipment and the copper alloy for electronic parts which contains and is characterized by the bird clapper from Remainder Cu and an unescapable impurity
[Claim 3] The electrical and electric equipment and the copper alloy for electronic parts indicated by the claim 1 characterized by conductivity being more than 80%IACS, or 2.
[Claim 4] The electrical and electric equipment and the copper alloy for electronic parts indicated by the claim 1 characterized by for conductivity being more than 80%IACS, and the conductivity after annealing being more than 70%IACS for 30 minutes at 800 degrees C, or 2.

[Translation done.]

JAPANESE [JP,2000-063968,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the copper alloy used for the contact-surface article with which ON-OFF of electrical circuits, such as electrical and electric equipment and a copper alloy for electronic parts especially various switches, and a motor commutator, is repeated.

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PRIOR ART

[Description of the Prior Art] It is required that the contact-surface article with which ON-OFF of electrical circuits, such as a switch and a motor commutator, is repeated cannot be easily worn out not to mention intensity and conductivity due to thermal resistance (be hard to soften in generation of heat by energization) and the arc discharge which happens further at the time of operation of ON->OFF. It is used for this use because an oxygen free copper (C10100, C10200), a tough pitch copper (C11000), etc. have high conductivity. Moreover, an oxygen free copper containing Ag (C10400, C10500, C10700), a tough pitch copper containing Ag (C11300, C11400, C11500, C11600), etc. which gave arc-proof abrasiveness are used. However, mechanical wear-resistant shortage according [these (Ag is entered) oxygen free coppers and (Ag is entered) a tough pitch copper] to intensity and heat-resistant shortage was a fault.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, intensity, conductivity, thermal resistance, arc-proof abrasiveness, mechanical-wear-proof nature, etc. are good, and can obtain a copper alloy with little (for [by which ON-OFF of electrical circuits such as electrical and electric equipment and an object for electronic parts especially a switch and a motor commutator is repeated] contact-surface articles) decline in conductivity by generation of heat by energization.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] On the other hand, to JP,2-25531,A, the mechanical property of the above-mentioned material and thermal resistance are raised, and the Cu-Fe-P-Ag alloy is indicated as a copper alloy which has improved mechanical abrasion resistance. P:0.02 - 0.15wt%, Ag:0.01 - 0.3wt%, it consists of the remainder Cu and an unescapable impurity, and this aims at mechanical wear-resistant improvement, without reducing conductivity by the deposit of Fe2P, and aims at improvement in arc-proof abrasiveness by addition of Ag simultaneously Fe:0.02 - 0.5wt%. However, although the original conductivity was high in the case of this Cu-Fe-P-Ag alloy, it turns out that conductivity may fall remarkably while in use as a contact-surface article.
[0004] Fe2P which this might have the large temperature rise, and might reach to the melting point or near the melting point near the contact, therefore deposited depending on conditions especially in the contact-surface article in which ON-OFF of electrical circuits, such as a switch and a motor commutator, is repeated are for dissolving again. If conductivity falls when Fe2P dissolve, generating of the Joule's heat will increase, **** of the generated Joule's heat will also be overdue, and the fall of the life of a contact-surface article will be caused. this invention was made in view of the above-mentioned trouble of the conventional technology, and intensity, conductivity, thermal resistance, arc-proof abrasiveness, its mechanical-wear-proof nature, etc. are good, and it aims at decline in conductivity obtaining few electrical and electric equipment and copper alloy for electronic parts at generation of heat by energization.

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MEANS

[Means for Solving the Problem] In order to solve the aforementioned technical problem, as a result of inquiring wholeheartedly about a Cu-Ag-Fe-P system alloy, by controlling Fe and P in the minute amount range, this invention person finds out that the above-mentioned purpose can be attained, and came to make this invention. Cu alloy concerning this invention Namely, Ag:0.01 - 0.3wt%, Less than [Fe:0.005-0.02wt%] and P:0.005 - 0.05wt% are included. Furthermore, the need is accepted. B, C, S, calcium, V, Ga, germanium, Nb, Mo, Hf, Ta, Bi, Pb, Be, Mg, aluminum, Ti, Cr, Mn, nickel, one sort or two sorts or more of elements chosen from from while of each element [of Co, Zr, Cd, In, Sb, Si, Sn, Te, and Au] 0.001 - 0.1wt%, and Zn:0.001 - 1wt% -- the sum total -- less than [1wt%] -- it contains and consists of the remainder Cu and an unescapable impurity Moreover, the copper alloy concerning this invention is characterized by that conductivity is more than 80%IACS and the conductivity after annealing being more than 70%IACS for 30 minutes at 800 more degrees C.
[0006]
[Embodiments of the Invention] Next, the component of the copper alloy concerning this invention and the reason for limitation of conductivity are explained.
(Ag) Ag is an element which suppresses wear by arc discharge, without reducing most conductivity. Moreover, there is an effect which intensity and thermal resistance are raised and also suppresses mechanical wear. However, even if the effect is small and contains exceeding 0.3wt%, while the effect is saturated with less than [0.01wt%], cost goes up. Therefore, Ag may be 0.01 - 0.3wt%. The still more desirable range is 0.03 - 0.15wt%.
[0007] (Fe and P) They have the effect which intensity and thermal resistance are raised and suppresses mechanical wear, Fe and P suppressing decline in conductivity by forming a compound. However, these effects of any element are small less than [0.005wt%], and it becomes [conductivity] low by generation of heat by energization and is not desirable, if Fe exceeds more than 0.02wt% and P exceeds 0.05wt(s)%. Therefore, Fe may be as less than [0.005-0.02wt%], and P may be 0.005 - 0.05wt%. The still more desirable range of P is 0.005 - 0.02wt%.
[0008] (Accessory constituent) Accessory-constituent elements, such as B, C, S, calcium, V, Ga, germanium, Nb, Mo, Hf, Ta, Bi, Pb, Be, Mg, aluminum, Ti, Cr, Mn, nickel, Co, Zr, Cd, In, Sb, Si, Sn, Te, Au, and Zn, can be suitably added by the tolerance of conductivity in order to raise further intensity, thermal resistance, and mechanical-wear-proof nature. These elements have a small effect less than [0.001wt%], and if each element other than Zn exceeds and Zn exceeds 1wt% 0.1wt(s)%, decline in conductivity becomes remarkable and is not desirable. therefore, one sort or two sorts or more of elements with which Zn was chosen for each element other than Zn from from 0.001wt(s)% - 0.1wt% among the above-mentioned elements while of 0.001wt(s)% - 1wt% -- the sum total -- less than [1wt%] -- it can contain
[0009] (Conductivity) The improvement in a life of the contact-surface article with which ON-OFF of electrical circuits, such as a switch and a motor commutator, is repeated is attained by preventing a temperature rise. In order to prevent a temperature rise, while suppressing generating of the Joule's heat, it is important to **** the generated Joule's heat. It is desirable to carry out conductivity for that purpose more than 80%IACS, and, less than [it], it causes the fall of a life. The still more desirable range is more than 85%IACS. It is possible to attain the conductivity more than 85 more%IACS more than 80%IACS at the copper alloy of the aforementioned composition.
[0010] (It is the conductivity after annealing for 30 minutes at 800 degrees C) Near a contact may have the largest temperature rise and may attain the above-mentioned contact-surface article to the melting point or near the melting point depending on conditions. Even in such a case, in order to make it conductivity not fall greatly, it is necessary to stop the content of Fe and P within the limits of the above, and to restrict the amount of dissolution at the time of becoming an elevated temperature. As an index of the conductivity when dissolution-izing at an elevated temperature, when the conductivity after annealing is used for 30 minutes at 800 degrees C, it is desirable to carry

out this value more than 70%IACS, and, less than [this], it causes the fall of the life of a contact-surface article. It became possible to attain the conductivity more than 70%IACS (800 degrees C after annealing during 30 minutes) by the copper alloy of the aforementioned composition.

[Translation done.]

EXAMPLE

[Example] Next, the example of this invention is explained below with the example of comparison. The air dissolution was carried out under charcoal covering in the kryptol furnace, the copper alloy of the chemical composition shown in Table 1 was cast to the book mold, and the 50x80x200mm ingot was produced. This ingot was heated at 900 degrees C, and after hot rolling, water quenching was carried out immediately and it considered as hot-rolling material with a thickness of 15mm. In order to remove the scale of the front face of this hot-rolling material, the front face was cut by the grinder. After cold-rolling this and giving deposit annealing of 2 hours at 350-500 degrees C, 30% of finish cold rolling was performed. Thus, the examination was presented with the material adjusted to 2.0mm of board thickness. About these test specimens, tensile strength, proof stress, hardness, thermal resistance, conductivity, and arc-proof abrasiveness were investigated in the following way.
[0012]
[Table 1]

表1

	No.	Cu	Ag	Fe	P	副成分
本発明例	1	残部	0.01	0.012	0.012	–
	2	残部	0.04	0.012	0.012	–
	3	残部	0.10	0.012	0.012	–
	4	残部	0.15	0.012	0.012	–
	5	残部	0.27	0.012	0.012	–
	6	残部	0.10	0.006	0.006	–
	7	残部	0.10	0.018	0.018	–
	8	残部	0.10	0.018	0.042	–
	9	残部	0.10	0.012	0.012	B:0.01, C:0.001, Be:0.008
	10	残部	0.10	0.012	0.012	Ni:0.005, Mg:0.04, Al:0.01
	11	残部	0.10	0.012	0.012	S:0.005, Ca:0.001, Ti:0.02
	12	残部	0.10	0.012	0.012	V:0.001, Cr:0.02, Mn:0.01
	13	残部	0.10	0.012	0.012	Ga:0.03, Ge:0.02, Si:0.01
	14	残部	0.10	0.012	0.012	Nb:0.01, Co:0.01, Zr:0.03
	15	残部	0.10	0.012	0.012	Mo:0.003, Hf:0.008, Zn:0.3
	16	残部	0.10	0.012	0.012	Ta:0.004, Cd:0.02, In:0.02
	17	残部	0.10	0.012	0.012	Bi:0.0009, Pb:0.008, Sb:0.005
	18	残部	0.10	0.012	0.012	Te:0.01, Au:0.01
比較例	19	残部	0.005*	0.012	0.012	–
	20	残部	0.35*	0.012	0.012	–
	21	残部	0.10	0.004*	0.004*	–
	22	残部	0.10	0.025*	0.025	–
	23	残部	0.10	0.10 *	0.034	–
	24	残部	0.10	0.026*	0.056*	–
	25	残部	0.10	0.012	0.012	Mn:0.2 *
	26	残部	0.10	0.012	0.012	Zn:1.6 *

*本発明の規定範囲外の箇所

[0013] <Tensile strength, proof stress> JIS Z It applied to the method given in 2241 correspondingly. In addition, proof stress adopted 0.2% of permanent sets by the offset method. A test piece is JIS. Z The No. 5 test piece of 2201 was used.
<Hardness> JIS Z It applied to the method given in 2244 correspondingly. In addition, the test load was set to 5kgf (s).
The hardness after heating a <heat-resistant> test specimen at each temperature for 1 hour was measured, and it asked for the temperature which becomes 90% of initial hardness.
[0014] <Conductivity> JIS H It applied to the method given in 0505 correspondingly. Measurement of electric resistance used the double bridge. In addition, measurement was carried out about the material which annealed the above-mentioned test specimen (product) and its test specimen for 30 minutes at 800 degrees C.
The electrode made from an oxygen free copper (diameter phiof root5mm and diameter phiof nose of cam0.7mm) was used for <arc-proof abrasiveness> cathode, and each test specimen was used for the anode plate. The wear depth by the arc discharge of each test specimen (anode plate) when opening cathode wide at the rate of 1 mm/s was measured having contacted two electrodes and passing current on condition that open-circuit-voltage 12V and direct-current 100A.
[0015] The above results of an investigation are shown in Table 2. Any property of No.1-17 of the example of this invention is better than these results. however, No. -- 1 and 2 have less Ag and its arc abrasion loss is a little large No.6 have Fe and lower P and intensity and thermal resistance are a little low. No. -- as for 7 and 8, although there are more Fe and P and intensity and thermal resistance are a little high, the conductivity after annealing has become a little low As for No.9-18, intensity and thermal resistance have become a little high by accessory-constituent addition. On the other hand, since comparison alloy No.19 have little Ag, its arc abrasion loss is large. Although

comparison alloy No.20 are good as for any property, the improvement in a property which balanced increase in quantity of Ag as compared with No.5 is not accepted. Since comparison alloy No.21 have little Fe/P, intensity and its thermal resistance are low. since many, although, as for comparison alloy No.22-24, intensity and thermal resistance are [Fe or (and) P] high -- No. -- about 22 and 23, the conductivity after annealing is low, and the conductivity after a product and annealing is low about No.24 No. -- 25 and 26 have the high content of an accessory constituent, and the conductivity of a product and the conductivity after annealing are low

[0016]

[Table 2]

表2

	No.	引張強さ (N/mm²)	耐力 (N/mm²)	硬さ (Hv)	耐熱性 (℃)	導電率(%IACS) 製品	導電率(%IACS) 焼鈍後	アーク摩耗深さ (μm)
本発明例	1	320	300	105	390	90	84	25
	2	330	310	107	390	90	84	22
	3	340	320	110	400	90	84	20
	4	350	330	113	410	90	84	18
	5	360	340	115	420	89	83	16
	6	320	300	104	350	90	86	20
	7	350	330	112	410	89	77	20
	8	360	340	116	420	85	73	20
	9	360	340	117	420	87	81	19
	10	370	350	118	410	85	79	19
	11	370	350	119	430	85	79	19
	12	360	340	116	430	85	73	18
	13	360	340	116	420	86	80	18
	14	360	340	118	430	86	77	19
	15	350	330	112	410	85	77	20
	16	360	340	114	430	85	79	19
	17	350	330	113	410	87	81	20
	18	350	330	114	410	86	80	19
比較例	19	310	290	101	380	90	84	30 *
	20	360	340	116	420	89	83	16
	21	310	290	102	330 *	90	87	20
	22	360	340	115	420	87	69 *	20
	23	380	360	121	450	90	58 *	20
	24	370	350	119	430	77 *	68 *	20
	25	360	340	115	420	68 *	64 *	20
	26	360	340	116	420	73 *	69 *	20

*特に特性の劣る箇所

[Translation done.]